The Examiner has asked the Applicants to explain why claims 1-13 and 20-28 are patentable over U.S. Patent No. 5,520,114 to Guimard et al. ("Guimard"). Guimard is concerned with precisely controlling the timing of sequentially detonated charges in applications such as mining and blasting. In such applications, it is desirable to be able to precisely control the detonation sequence of a plurality of charges to maximize and control the effect of the blasting operation. To this end, Guimard discloses a system for programming the delay times of individual ignition modules to effect a desired detonation sequence. Once the delay times are programmed into the individual modules, all of the devices are fired, in the programmed sequence, by transmitting a firing signal from the firing control module 17.

The present invention concerns a networked electronic ordnance system having features not present in Guimard and which make the claimed invention suitable for a variety of applications, such as bolt cutters or cable cutters, where the Guimard system would be problematic. Specifically, claims 1-13 concern a networked electronic ordnance system comprising a plurality of pyrotechnic devices interconnected with a bus controller by a network. Each of the pyrotechnic devices comprises a logic device having a unique identifier. The bus controller is operative to selectively address, with a single command, one or more of the pyrotechnic devices using the unique identifiers. The networked system of claims 1-13 allows complete flexibility in testing, loading, and firing any combination of the pyrotechnic devices that are connected to the network.

For example, in some instances it may be desirable to fire or test only one of the pyrotechnic devices, while in other instances it may be desirable to fire or test several of the pyrotechnic devices simultaneously. With a single command, the bus controller can access any one of the pyrotechnic devices, all of the pyrotechnic devices, or any combination of the pyrotechnic devices on the network. This feature is not disclosed or suggested by Guimard. Hence, claims 1-13 are patentable over Guimard.

Claims 20 and 22-27 are directed to a method of operating a pyrotechnic device connected to a bus controller through a network. These claims require both altering an analog condition of the network to a firing condition and transmitting a digital firing signal from the bus controller to the armed pyrotechnic device. This claimed combination is not disclosed or suggested in Guimard. Requiring the combination of an analog condition and a firing signal enhances safety. This claim also specifies that the digital arming signal uses the unique identifier of the logic device associated with the pyrotechnic device, thereby allowing the controller to selectively fire any, all, or any combination of the pyrotechnic devices connected to the network. Hence, claims 20 and 22-27 are patentable over Guimard.

Similarly, claims 28-30 are directed to a method of operating a networked pyrotechnic device wherein the pyrotechnic is only fired in the presence of both a digital firing command and an analog network condition. These claims are patentable over Guimard for the reasons given above.

New claims 31-62 have been added to further define certain patentable aspects of the present invention. Claims 31 and 32 depend from claim 1 and are patentable for the reasons given above. Moreover, these claims recite further patentable distinctions over Guimard. Specifically, claim 31 specifies that the bus controller assigns the unique identifiers to each of the logic devices. Claim 32 further specifies that the bus controller assigns the unique identifiers to the logic devices each time the ordnance system is powered up. These features are not disclosed or suggested in Guimard and they are beneficial because they allow pyrotechnic devices to readily be added or removed from the system. Therefore, claims 31 and 32 are patentable over Guimard.

New claims 33-34 are directed to a networked electronic ordnance system comprising a plurality of pyrotechnic devices. Each pyrotechnic device comprises a logic device associated with a unique identifier. A given pyrotechnic device can only be fired when both (1) the analog condition of the network has been modified to a firing condition and (2) a digital firing command includes the unique identifier of the logic device for the particular pyrotechnic device. These claims are patentable over Guimard for the reasons given above, e.g., in connection with claims 20 and 28.

Claims 35-37 are directed to a networked electronic ordnance system wherein the energy reserve capacitors of the pyrotechnic devices can be charged in approximately five milliseconds or less. Claim 36 further specifies the current carried by the network is in the order of magnitude of milliamperes. As is discussed in the

specification, the present ordnance system uses low voltage and low current power, which allows the use of thin cables and facilitates the integration of the networked electronic ordnance system into applications where weight is an issue, such as aircraft and missile applications. By contrast, the Guimard system is a high current system having a minimum trigger current on the order of 130 mA. (Col. 3, lines 21-23). Claim 37 further specifies that each energy reserve capacitor has a capacitance on the order of two microfarads. By contrast, the capacitor 29 in Guimard has a capacitance of 100 microfarads, which is 50 times greater than the capacitance specified in claim 37. Using the claimed low capacitance facilitates rapid charging of the energy reserve capacitor, even at the relatively low currents.

Claim 38 is directed to a pyrotechnic device comprising a logic device, an initiator and a Faraday cage comprising a conductive shell around the logic device and the initiator for shielding the logic device and the initiator from the effects of external electric fields and static charges. The Faraday cage is beneficial in preventing inadvertent ignition of the pyrotechnic device in strong electromagnetic radiation environments.

Claims 39-44 are directed to a method for testing an operating condition of a pyrotechnic device. The test is initiated by transmitting a digital firing command from the bus controller and onto the network. This digital test command uses the unique identifier of the logic device associated with a particular pyrotechnic device. Hence, the

method can be used to individually test any of a plurality of pyrotechnic devices in a networked system.

Claims 45 and 46 are directed to methods for testing the operating status of a networked ordnance system. In claim 45, the method includes transmitting a test signal over the network from the bus controller to one or more pyrotechnic devices. One or more pyrotechnic devices receive the test signal and transmit a response signal that is received by the bus controller and compared to a predetermined condition to determine the status of the network. For example, the bus controller can infer that the network is operating properly if the expected response signal is received back within an expected time. Claim 46 determines the status of the network by sensing a current drawn by the bus controller and/or a voltage of the bus controller. These claimed network test methods are beneficial in increasing the safety and performance of the ordnance system.

Claims 47 and 48 relate to an assembly for a pyrotechnic system comprising a plurality of pyrotechnic devices mounted on a substrate. Mounting multiple pyrotechnic devices on a single substrate is beneficial because it simplifies manufacturing and packaging of the pyrotechnic devices. Claim 48 further specifies connecting the logic device and initiator of a given pyrotechnic device by circuit traces on the substrate. This claimed feature reduces the need for wire bonding, thereby further simplifying packaging and increasing reliability.

Claims 49-53 are directed to a method of operating a networked ordnance system comprising a bus controller and a plurality of pyrotechnic devices, wherein the bus controller selectively addresses, with a single command, one or more of the pyrotechnic devices. Hence with a single command, the bus controller can access any, all or any combination of the pyrotechnic devices on the network. This method is beneficial because it allows complete flexibility in testing, loading, and firing any combination of the pyrotechnic devices that are connected to the network.

Claims 54-61 are directed to a pyrotechnic device having an initiator and a logic device mounted on a substrate. Mounting the components of the pyrotechnic device on a substrate is beneficial because it simplifies manufacturing and packaging of the pyrotechnic device and increases the device's reliability.

Claims 62-63 are directed to a networked electronic ordnance system having a plurality of pyrotechnic devices and a bus controller. Each of the pyrotechnic devices comprises a logic device having a unique identifier. In claim 62, the bus controller assigns the unique identifiers to each of the logic devices. Claim 63 further specifies that the bus controller assigns the unique identifiers to the logic devices each time the ordnance system is powered up. As was discussed above, these claimed features are beneficial because they allow pyrotechnic devices to readily be added or removed from the system.

In view of the foregoing, claims 1, 4-13, 20 and 22-65 are believed to be in condition for allowance. The Examiner is invited to telephone the undersigned attorney at (312) 775-8000 if any unresolved matters remain.

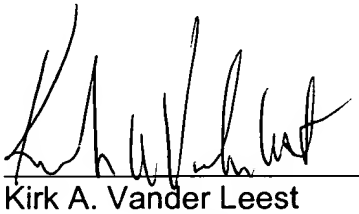
Fee For Claims

	Claims Remaining After Amendment	Highest No. Previously Paid For	Extra Present	Rate	Total
Total Claims	56	30	26	X $18	$ 468.00
Indep Claims	15	4	11	X $84	$ 924.00
Multiple dependent claim presented ($260 if any present)				$.00	$
Total Addtl. fee				$.00	$1,392.00

Fee Authorization

Please charge any fees due in connection with this submission, including the extension fee under 1.17(a)(2), to Deposit Account No. 13-0017.

Respectfully submitted,



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AMENDMENTS TO THE CLAIMS

1. A networked electronic ordnance system, comprising:

-a plurality of pyrotechnic devices connected by a network, each said pyrotechnic device comprising a logic device having a unique identifier; and

a bus controller connected to said plurality of pyrotechnic devices through said network, said bus controller being ~~adapted~~operative to selectively address, with a single command, one or more of said pyrotechnic devices using said unique identifiers.

4. The networked electronic ordnance system of claim ~~2~~1, wherein said bus controller transmits and receives multiplexed digital signals over said network.

20. A method for operating a pyrotechnic device connected to a bus controller through a network, the pyrotechnic device having a logic device associated with a unique identifier, ~~a bus interface,~~ and an initiator, comprising:

transmitting a digital arming command from the bus controller to the pyrotechnic device, said digital arming command using the unique identifier of the logic device associated with the pyrotechnic device;

altering ~~th~~ean analog condition of the network to a firing condition; and

transmitting a digital firing command from the bus controller to the armed pyrotechnic device.

22. The method of claim 20, wherein the digital firing command includes ~~said~~ an address frame ~~comprises~~ comprising the unique identifier of the logic device associated with the pyrotechnic device.

23. The method of claim 20, wherein the digital firing command ~~said address frame~~ comprises an all-fire signifier.

28. A method for operating a pyrotechnic device having a logic device associated with a unique identifier, ~~a bus interface,~~ and an initiator, the pyrotechnic device connected to a bus controller through a network, comprising:

receiving a digital arming command from the bus controller, said digital arming command using the unique identifier of the logic device associated with the pyrotechnic device;

recognizing the unique identifier in the digital arming command ~~and the digital arming command~~;

arming the pyrotechnic device;

receiving a digital firing command having an address frame from the bus controller;

recognizing the contents of the address frame and the digital firing command;

checking ~~the~~ an analog condition of the network; and

firing the pyrotechnic device if the analog condition of the network corresponds to an analog firing condition.